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EFFECTS OF TRASH DEPOSITS IN COTTON PICKER BASKETS^{1/}

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INTRODUCTION

The tremendous increase in the practice of mechanical picking of cotton in many areas of the Cotton Belt in the past 15 years has created various problems for the farmer, the picker manufacturer, and the ginner. One of the major problems concerns foreign matter in the cotton delivered to the gin. In addition to the general problems of trash removal, there has been speculation that trash accumulations in certain areas of the picker basket may result in bales with a lower grade of cotton in one section of the bale than in another section.

Studies were conducted at Stoneville, Miss., in 1962 and 1963 to determine the extent of these trash pockets in the picker basket and the relation, if any, of this accumulated trash to variations in lint grade classification and lint foreign matter content.

Brief Description of Problem

The bottom and sides of the storage basket on a mechanical picker are usually constructed of wire mesh. Metal grates on top of the basket allow the air from the elevating fan and some trash to be separated from the seed cotton as it is blown into the basket. Some of the heavier particles of trash tend to settle in the picker basket with the incoming seed cotton. The particles of trash accumulate in different degrees in various areas of the basket with the heaviest concentrations usually in the rear. The trash accumulations are often evident after dumping the cotton into a trailer (Figs. 1 and 2).

^{1/} Cooperative investigations of the Agricultural Engineering Research Division, Agricultural Research Service, U.S. Department of Agriculture, and the Delta Branch, Mississippi Agricultural Experiment Station, Stoneville. Contributions to Regional Cotton Mechanization Project S-2.

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Figure 1. Showing accumulated trash hanging onto the rear of a mechanical picker basket.



Figure 2. Cotton being dumped into a trailer from the basket of a two-row cotton picker.

Experiments Conducted in 1962

In conducting studies in 1962, six bales of Stoneville 7-A cotton were machine harvested, two at a time, under three field conditions and at three dates as follows:

(1) Two bales of undefoliated cotton were harvested between 2:30 and 5:00 p.m. on September 27, 1962.

(2) Two bales of defoliated cotton were harvested between 2:45 and 5:00 p.m. on October 12, 1962.

(3) Two bales of defoliated cotton were harvested between 2:35 and 5:00 p.m. on November 12, 1962 -- 5 days after the first frost.

In each instance the cotton was harvested 3 to 4 days after a rain and all lots were harvested in the afternoon when the cotton and stalks were dry.

Seed cotton fractionation samples were taken for foreign matter content determinations as the cotton reached levels of 18, 36, and 54 inches in the cotton basket (Figs. 3 and 4).

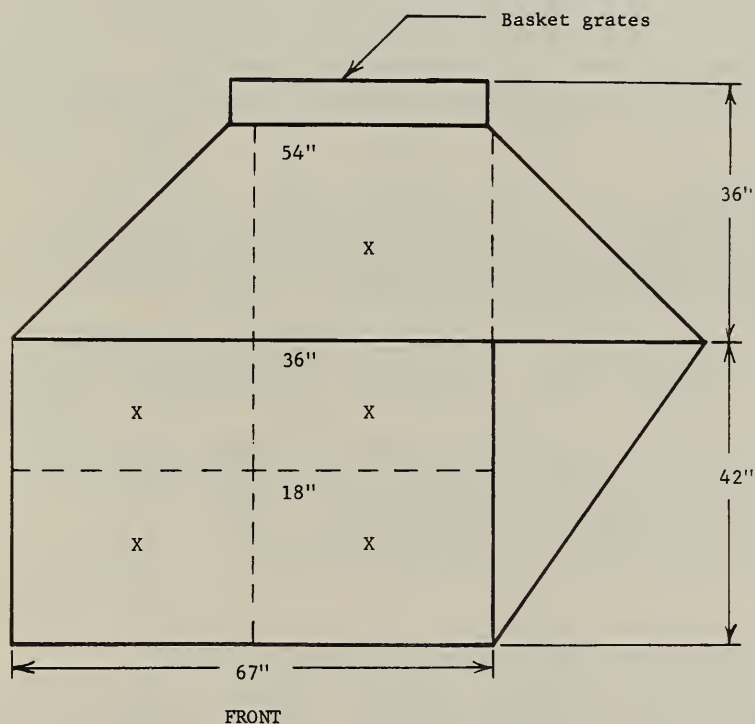


Figure 3. Two-row cotton picker basket showing sampling locations used in trash concentration study.

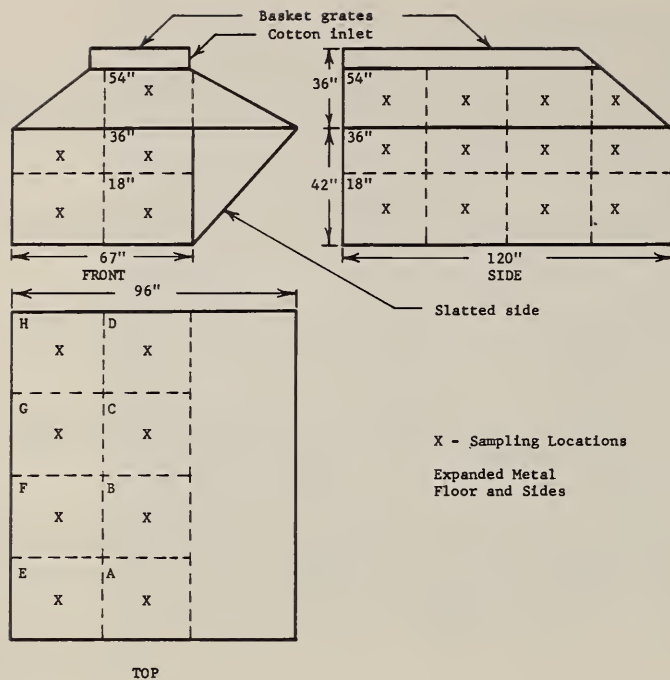


Figure 4. Two-row cotton picker basket showing sampling locations used in trash concentration study.

Upon arrival of each set of paired bales at the gin, one bale was left as dumped in the field from the picker basket into the trailer, in the conventional manner, and was processed at the gin without any further handling. The other bale was composited or mixed in the trailer before it was processed at the gin.

The following machinery arrangement was used in processing all bales at the gin: Tower drier, 6-cylinder cleaner, bur machine with stick remover attachment, 7-cylinder cleaner, extractor-feeder, and double lint cleaners.

Comparative sets of one dozen samples were taken successively during ginning of each bale, at the wagon, feeder apron, and lint slide.

There was a wide range in the quantity of foreign matter making up the average content of each type of trash in samples taken at 18-, 36-, and 54-inch heights above the bottom of the mechanical picker basket (table 1). These data illustrate the uneven distribution of foreign matter in a basket of machine-picked cotton.

Further study of these data shows that the concentration of foreign matter and pin trash becomes heavier as the height of the cotton in the basket increases (Fig. 5). This is probably because there is less side area through which the air and trash can escape as the basket fills.

Table 1. Foreign matter content of machine-picked seed cotton samples taken from three levels in mechanical picker baskets, 1962^{1/}

Field condition, picking date, and type of foreign matter	Picker basket foreign matter content and range of samples						
	At 18-inch level		At 36-inch level		At 54-inch level		At all levels
	Average	Range	Average	Range	Average	Range	Average
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
<u>Undeveloped,</u> <u>picked 9-27-62:</u>							
Hulls-----	1.9	1.0-4.1	3.0	1.6-4.7	2.2	1.0-3.1	2.4
Sticks and stems	.5	.2- .8	.5	.3- .7	.7	.4- .9	.5
Grass-----	.2	.0- .6	.2	.0- .5	.2	.0- .4	.2
Large leaf-----	1.8	1.4-2.3	2.2	1.3-3.0	2.8	1.9-3.6	2.2
Small leaf-----	1.0	.6-1.3	1.2	.9-1.7	.7	1.1-1.8	1.1
Total leaf-----	2.8	2.4-3.3	3.4	2.5-4.4	3.5	3.1-4.8	3.3
Pin trash-----	1.3	1.2-1.9	1.6	1.1-2.2	1.7	1.2-2.0	1.5
TOTAL ALL TYPES	6.7	5.1-9.1	8.7	6.5-11.8	8.3	6.0-10.2	7.9
<u>Defoliated,</u> <u>picked 10-12-62:</u>							
Hulls-----	3.5	1.6-6.3	4.1	2.7-6.2	3.7	1.9-4.7	3.8
Sticks and stems	.5	.3- .8	.5	.2- .7	.5	.1- .8	.5
Grass-----	.2	.0- .9	.2	.0- .4	.2	.0- .3	.2
Large leaf	.9	.3-1.6	.8	.4-1.1	1.0	.5-1.7	.9
Small leaf	1.2	.9-1.5	1.3	.9-1.9	1.5	1.0-1.8	1.3
Total leaf	2.1	1.5-2.9	2.1	1.8-2.7	2.5	1.9-3.2	2.2
Pin trash-----	1.5	1.0-2.1	1.6	1.2-2.2	2.0	1.7-2.5	1.6
TOTAL ALL TYPES	7.8	4.9-11.6	8.5	6.3-10.9	8.9	7.9-10.1	8.3
<u>Defoliated,</u> <u>picked 11-12-62,</u> <u>after frost:----</u>							
Hulls-----	3.7	1.7-7.6	4.5	2.1-9.9	4.8	2.3-9.9	4.2
Sticks and stems	.7	.0-1.6	1.0	.6-1.5	1.0	.6-1.7	.9
Grass ^{2/} -----	.0	.0- .2	.1	.0- .4 ^{2/}	.0	.0- .2 ^{2/}	.0
Large leaf-----	.6	.2-1.1	.5	.2- .9	.8	.4-1.2	.6
Small leaf-----	1.5	1.0-2.0	1.6	.9-2.1	2.0	1.2-2.7	1.6
Total leaf-----	2.1	1.4-2.5	2.1	1.5-2.7	2.8	1.8-3.6	2.2
Pin trash-----	1.8	1.4-2.4	2.3	1.5-4.4	2.9	1.7-4.6	2.2
TOTAL ALL TYPES	8.3	5.8-12.5	10.0	6.3-18.0	11.5	7.1-19.4	9.5

^{1/} Samples were taken as follows: Undeveloped--8 at the 18-inch level; 8 at the 36-inch level; 4 at the 54-inch level. Both defoliated--16 at the 18-inch level; 16 at the 36-inch level; 8 at the 54-inch level.

^{2/} Less than 0.1 percent.

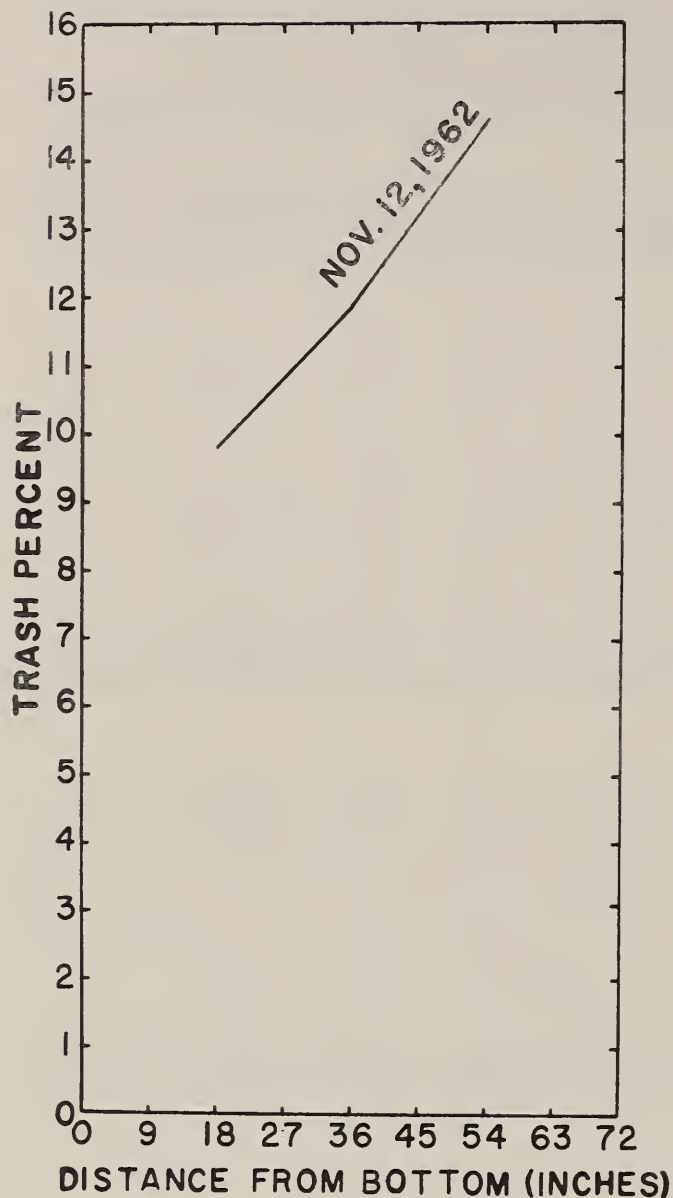


Figure 5. Showing the increase in trash content of cotton with increase in height of cotton in a picker basket, based on samples from rear section of the basket.

The overall total foreign matter and hull content of the cotton was greater for the later defoliated cotton, but the total leaf content was greater for the earlier undefoliated cotton.

Table 2 shows comparisons of the combined averages of seed cotton foreign matter content of the three bales of cotton dumped into the trailer and ginned "as is" and the three corresponding bales dumped into the trailer and composited or mixed before ginning.

Table 2. Combined averages of machine-picked seed cotton foreign matter content representing the cotton dumped into the trailer and ginned "as is" as compared to corresponding bales that were dumped into the trailer and then composited or mixed before being ginned, 1962¹

Type of foreign matter	Wagon sample		Feeder sample	
	Dumped into trailer and ginned "as is"	Dumped into trailer and composited before ginning	Dumped into trailer and ginned "as is"	Dumped into trailer and composited before ginning
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
Hulls-----	3.7	3.0	0.6	0.6
Sticks and stems---	.6	.6	.3	.3
Grass-----	.2	.1	.1	.1
Large leaf-----	1.5	1.3	.4	.5
Small leaf-----	1.3	1.3	.7	.7
Total leaf-----	2.8	2.6	1.1	1.2
Pin trash-----	1.6	1.8	.4	.4
TOTAL ALL TYPES	8.9	8.1	2.5	2.6
Range in total foreign matter ^{2/}	4.5 to 13.3	5.4 to 15.7	1.7 to 3.4	1.5 to 5.2

^{1/} Figures are averages of 36 samples obtained as follows: 12 samples from each of 3 bales taken progressively during ginning.

^{2/} Extremes taken from the 36 samples.

A study of these data shows that although there were average differences in wagon sample foreign matter content between the two treatments, the equalizing effects of processing the cotton through the cleaning system of the gin provided almost identical average foreign matter distribution in the cotton at the feeder apron. This comparatively uniform foreign matter distribution in the seed cotton at the feeder apron also resulted in the same lint grade, even for all individual samples, and very closely comparable lint foreign matter content (table 3). In final analysis, therefore, compositing or mixing the machine-picked cotton before cleaning and ginning offered no advantage over the uncomposited cotton.

Table 3. Classification results, foreign matter content of lint, and moisture content data associated with the cleaning and ginning of corresponding bales of uncomposited and composited mechanically harvested cotton, 1962

Field conditions, harvesting date, and test items	Seed cotton treatment before ginning	
	Dumped into trailer and ginned "as is"	Dumped into trailer and composited before ginning
<u>Undeveloped, harvested 9-27-62:</u> ^{1/}		
Grade, index-----	94.0	94.0
Staple, length-----1/32 inch--	33.0	33.0
Foreign matter content of lint--percent	1.98	1.95
<u>Moisture content:</u>		
Wagon sample-----do----	14.0	12.5
Feeder sample-----do----	10.6	11.1
Lint sample-----do----	5.2	5.0
<u>Defoliated, harvested 10-12-62:</u> ^{1/}		
Grade, index-----	99.0	99.0
Staple length-----1/32 inch--	34.0	34.0
Foreign matter content of lint--percent	2.00	2.16
<u>Moisture content:</u>		
Wagon sample-----do----	10.3	11.2
Feeder sample-----do----	8.1	7.6
Lint sample-----do----	5.2	4.6
<u>Defoliated, harvested 11-12-62</u> <u>after frost:</u> ^{1/}		
Grade, index-----	94.0	94.0
Staple length-----1/32 inch--	33.0	33.0
Foreign matter content of lint--percent	1.89	2.02
<u>Moisture content:</u>		
Wagon sample-----do----	11.0	10.5
Feeder sample-----do----	8.6	7.6
Lint sample-----do----	5.3	4.8
<u>All three of above combined:</u> ^{2/}		
Grade, index-----	95.7	95.7
Staple length-----1/32 inch--	33.3	33.3
Foreign matter content of lint--percent	1.96	2.04
<u>Moisture content:</u>		
Wagon sample-----do----	11.8	11.4
Feeder sample-----do----	9.1	7.9
Lint sample-----do----	5.2	4.8

^{1/} Averages of 12 samples.

^{2/} Averages of 36 samples.

Experiments Repeated in 1963

Even though very definite results were obtained in the 1962 experiments, it was decided to continue the study for at least one more year before publishing the information, to see if repeat results would be obtained. Accordingly, six bales of Stoneville 7-A cotton were again machine harvested, two at a time, under three field conditions and at three dates as follows:

(1) Two bales of undefoliated cotton were harvested on September 30, 1963.

(2) Two bales of defoliated cotton were harvested on October 16, 1963.

(3) Two bales of defoliated cotton were harvested after light frost on October 30, 1963.

The same machinery arrangement and sampling procedures were used at the gin in 1963 as were used in 1962.

Again there was a wide range in the quantity of foreign matter making up the average content of each type of trash in samples taken at 18-, 36-, and 54-inch levels in the mechanical picker basket (table 4). These data illustrate the somewhat uneven distribution of foreign matter in a basket of machine-picked cotton, and the test data for front to rear sampling positions show that trash accumulations tend to increase toward the rear of the picker basket (Fig. 6).

The data in table 4 also show that the pin trash content was uniform for all harvestings. However, the hull content of the cotton was greater for the later defoliated cotton, and the total leaf content was greater for the earlier undefoliated cotton.

Data showing the combined averages of seed cotton foreign matter content representing the three bales of cotton dumped into the trailer and ginned "as is" as compared to the three corresponding bales that were dumped into the trailer and then composited or mixed before being ginned, are presented in table 5.

A study of these data shows that although there were average differences in wagon sample foreign matter content between the two treatments, the equalizing effects of processing the cotton through the cleaning system of the gin provided identical average foreign matter distribution in the cotton at the feeder apron, table 5. This comparably uniform foreign matter distribution in the seed cotton at the feeder apron also resulted in essentially the same lint grade, and in closely comparable lint foreign matter content (table 6).

Table 4. Foreign matter content of machine-picked seed cotton samples taken from three levels in the mechanical picker baskets, 1963

Field condition, picking date, and type of foreign matter	Picker basket foreign matter content			
	At 18- inch level ^{1/}	At 36- inch level ^{1/}	At 54- inch level ^{1/}	At all levels ^{2/}
	Percent	Percent	Percent	Percent
<u>Undeveloped, picked 9-30-63:</u>				
Hulls-----	1.8	2.0	1.6	1.8
Sticks and stems-----	.5	.4	.5	.5
Grass-----	.5	.3	.1	.3
Large leaf-----	1.7	1.4	1.7	1.6
Small leaf-----	2.0	2.3	1.8	2.0
Total leaf-----	3.7	3.7	3.5	3.6
Pin trash-----	.2	.2	.2	.2
TOTAL ALL TYPES-----	6.7	6.6	5.9	6.4
Range of total foreign matter-----	5.5-8.1	5.2-7.9	3.9-8.5	3.9-8.5
<u>Defoliated, picked 10-16-63:</u>				
Hulls-----	2.8	2.5	2.5	2.6
Sticks and stems-----	.6	.4	.7	.6
Grass-----	.1	.2	.0	.1
Large leaf-----	1.0	1.1	1.3	1.1
Small leaf-----	1.8	2.0	1.9	1.9
Total leaf-----	2.8	3.1	3.2	3.0
Pin trash-----	.1	.2	.2	.2
TOTAL ALL TYPES-----	6.4	6.4	6.6	6.5
Range of total foreign matter-----	3.9-7.2	4.6-7.8	5.5-8.1	3.9-8.1
<u>Defoliated, picked after light frost, 10-30-63:</u>				
Hulls-----	2.4	2.7	2.1	2.4
Sticks and stems-----	.4	.6	.5	.5
Grass-----	.2	.1	.2	.2
Large leaf-----	.8	1.0	.6	.8
Small leaf-----	2.0	2.2	2.2	2.1
Total leaf-----	2.8	3.2	2.8	2.9
Pin trash-----	.2	.2	.1	.2
TOTAL ALL TYPES-----	6.0	6.8	5.7	6.2
Range of total foreign matter-----	4.9-7.6	4.9-10.2	3.9-7.2	3.9-10.2

^{1/} Figures are averages of 8 samples comprised of 4 taken at different locations at each of the 3 levels from 2 different picker baskets.

^{2/} Figures are averages of 24 samples--8 samples taken at each of 3 levels.

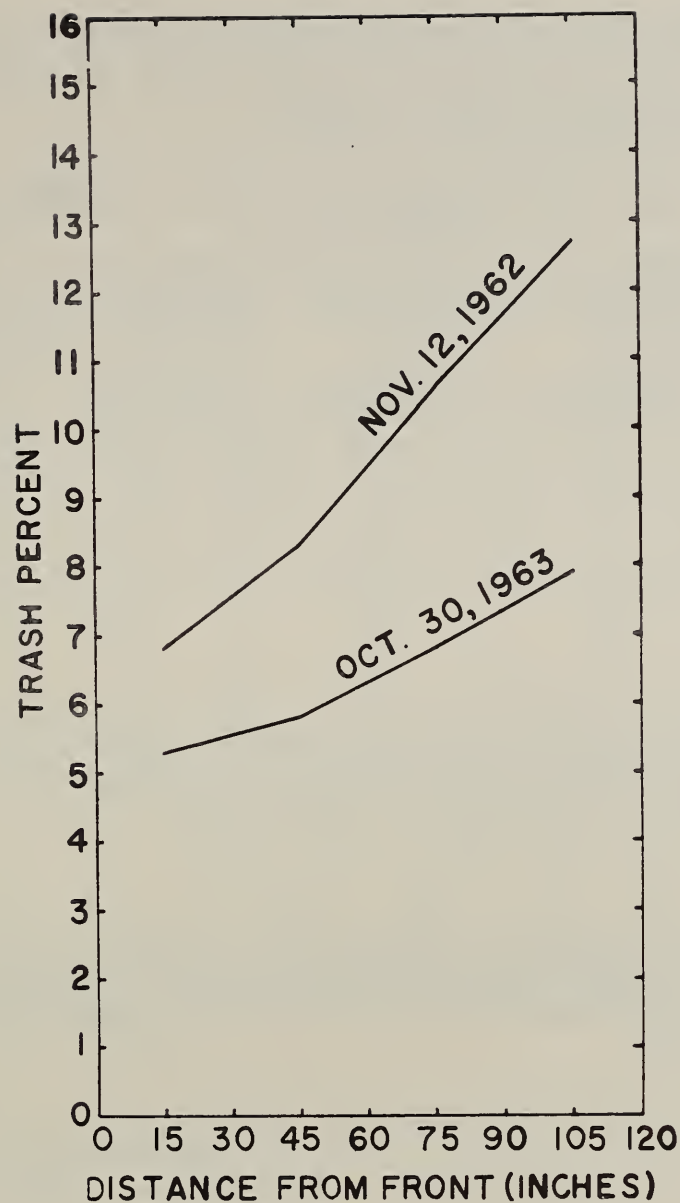


Figure 6. Showing how trash accumulations tend to increase toward the rear of a cotton picker basket, based on samples from front to rear locations at the 54-inch level.

Table 5. Machine-picked seed cotton foreign matter content representing the cotton dumped into the trailer and ginned "as is" as compared to corresponding bales that were dumped into the trailer and then composited or mixed before being ginned, 1963^{1/}

Type of foreign matter	Wagon sample		Feeder sample	
	Dumped into trailer and ginned "as is"	Dumped into trailer and composited before ginning	Dumped into trailer and ginned "as is"	Dumped into trailer and composited before ginning
	Percent	Percent	Percent	Percent
Hulls-----	1.7	2.2	0.5	0.5
Sticks and stems-----	.4	.6	.2	.2
Grass-----	.1	.2	.0	.0
Large leaf-----	1.0	1.1	.2	.2
Small leaf-----	1.6	1.9	.4	.4
Total leaf-----	2.6	3.0	.6	.6
Pin trash-----	.1	.1	.1	.1
TOTAL ALL TYPES-----	4.9	6.1	1.4	1.4

^{1/} Figures are averages of 36 samples obtained as follows: 12 samples from each of 3 bales taken progressively during ginning.

Table 6. Classification results, foreign matter content of lint, and moisture content data associated with the cleaning and ginning of corresponding bales of uncomposited and composited mechanically harvested cotton, 1963^{1/}

Test item	Seed cotton treatment before ginning	
	Dumped into trailer and ginned "as is"	Dumped into trailer and composited before ginning
<u>Classification data:</u>		
Grade, index-----	99.7	100.0
Staple length-----1/32 inch-----	32.9	32.8
Foreign matter content of lint-----percent----	1.81	1.67
<u>Moisture content:</u>		
Wagon sample-----do-----	8.8	9.3
Feeder sample-----do-----	7.3	7.3
Lint sample-----do-----	4.4	4.1

^{1/} Figures are averages of 36 samples from each of 3 bales obtained as follows: 12 samples taken progressively during ginning.

Summary, Conclusions, and Recommendations

Studies were conducted during two cotton harvesting seasons to determine the extent and cause of variations in the distribution of foreign matter in mechanically harvested cotton and its possible relation to variations in lint grade classification and lint foreign matter content.

For each of the two harvesting seasons, six bales of Stoneville 7-A cotton were machine harvested, two at a time, under three field conditions and at three dates.

Seed cotton fractionation samples for foreign matter content determinations were taken from the picker basket at 18-, 36-, and 54-inch levels during harvesting. Upon arrival of each set of paired bales at the gin, one bale was left as dumped from the picker basket into the trailer, in the conventional manner, and was processed at the gin without any further handling. The other bale was composited or mixed in the trailer before it was processed at the gin.

All bales were processed through the following machinery arrangement, normally recommended for handling machine-picked cotton at the gin: Tower drier, 6-cylinder cleaner, bur machine with stick remover attachment, 7-cylinder cleaner, extractor-feeder, and double lint cleaners.

Comparative sets of one dozen samples were taken successively during ginning of each bale at the wagon, feeder apron, and lint slide.

There was a variation or range in the foreign matter content of the cotton as represented by samples taken at 18-, 36-, and 54-inch levels in the mechanical picker basket.

A study of the data shows that although there were some differences in wagon sample foreign matter content between the composited and uncomposited cotton, the equalizing effects of processing the cotton through the cleaning system of the gin provided the same average foreign matter distribution in the cotton at the feeder apron. This resulted in essentially the same lint grades and closely comparable lint foreign matter content.

In final analysis, therefore, compositing or mixing the machine-picked seed cotton before cleaning and ginning offered no practical advantages over the uncomposited cotton.

In making an overall appraisal of this study, however, certain other facts should be considered. The experiments were made with cotton that was being picked for the first time and yielding from 1-1/2 to 2 bales per acre. The cotton was representative of the type harvested during most of the season.

It is possible that at certain times of the year and under some conditions, compositing would be of help. For instance, in early-season picking when an abundance of leaves are present and yield is low, the percentage of trash increases and the heavy, moist particles accumulate in the rear of the basket.

Likewise, in late-season picking, or "scrapping," there is a larger percentage of trash being picked while harvesting a basket of cotton. The additional time required to pick a basket of cotton causes additional dust and small trash to be blown through the cotton. The basket grates are usually cleaned only before each basket is dumped; but under conditions such as these, it may be advisable to dump the picker basket before it gets full, and clean the basket grates more frequently. When there is a very large amount of trash, the basket should be emptied before the section against the rear grates is filled.

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